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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/736,354	12/15/2003	Robert Oliver Buckingham	03485-P0009A	4073

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STAMFORD, CT 06905-5619

EXAMINER

PILKINGTON, JAMES

ART UNIT	PAPER NUMBER
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3682

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	01/30/2007	PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

**Office Action Summary**

Application No.

10/736,354

Applicant(s)

BUCKINGHAM ET AL.

Examiner

James Pilkington

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 16 November 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1,2,4,6-13,15,17-26,28-33 and 36 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,2,4,6-13,15,17-26,28-33 and 36 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Claim Rejections - 35 USC § 112***

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 11 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The term "sufficiently" 11 is a relative term which renders the claim indefinite. The terms "sufficiently" is not defined by the claims, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. (This issue was raised in the prior office action 7/17/06 but was not addressed by the applicant)

### ***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1, 2, 4, 5, 6-13, 15, 17-26, 28-33, 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stelle, USP 3,266,059, in view of Balczun et al, USP 5,902,050.

Re clm 1, Stelle discloses a link assembly for a robot arm comprising:

- First and second link members (75-80) configured in a cooperating mating relationship
- At least one wire (106 or 108) extending from said first link member to said second member, said at least one wire including a preload so as to maintain said link assembly under compression (Stelle states that all the joints are prestressed (C4/L37-52), if the joints are prestressed and it is the cables that hold the joints together then the cables must be preloaded).

Stelle does not disclose a resilient elastomer disposed between said first and second members and the elastomer is bonded to both of the first and second link members, and is maintained under compression.

Balczun teaches a resilient elastomer (plastic) bearing (28 part of spherical bearing 22) disposed between two members (20 and 24) and the elastomer is bonded to both of the first and second link members (C1/L35-38) and is maintained under compression (disposed between two elements) for the purpose of providing isolation of transmitted vibrations (C1/L6-10).

It would have been obvious to one having ordinary skill in the art at the time of the invention to modify the teachings of Stelle and provide a resilient elastomer bearing disposed between two members and the elastomer is bonded to both of the first and second link members, and is sufficiently thin and maintained under compression, as taught by Balczun, for the purpose of providing isolation of transmitted vibrations.

**\*\*The examiner notes, regarding the "whereby" clause in clm 1, that it has been held that when a "whereby" clause states a condition that is material to patentability, it cannot be ignored in order to change the substance of the invention." Accordingly, the "whereby" clause in this instance serves to narrow the claim and has been given patentable weight by the examiner. See MPEP 2111.04.\*\***

Re clm 2 and 9, Balczun discloses that the elastomer (28) is made of plastic which is a synthetic rubber and/or a laminate (clm 9).

Re clm 4, well a specific thickness is not disclosed by Balczun it would have been obvious to one having ordinary skill in the art at the time the invention was made to have utilized a specific thickness range in order to conform to the compressional force inputs, and/or cost specifications of the assembly, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

Re clm 6, Balczun discloses each surface of the elastomeric layer contiguous the member is secured (compressed between the members 20 and 24) so that in operation, relative movement between the members produces shear movement within the elastomer, the arrangement being such that the thinness of the layer reduces the tendency towards compression thereby imparting improved stability (reduces vibration) for the positioning of the components.

Re clm 7, Balczun discloses the elastomer means comprising a plurality of layers of elastomer (28 and 32).

Re clm 8, Balczun disclose an interleaving rigid layer (connection between 28 and 32) is bonded to adjacent elastomer layers to separate one layer from its neighbor (C2/L23-42).

Re clm 10, Balczun discloses the interleaving layer between each layer of elastomer (28 and 32) is of a material, which is bondable to or capable of being keyed to the elastomer.

Re clm 11, Balczun discloses that the interleaving layer is sufficiently stiff to reduce compression of the elastomer to a minimum during movement of the linked members (75-80). \*Only the elastomer layers compress\*

Re clm 12 and 13, Balczun discloses that the interleaving layer comprises a metal layer, a resin layer (plastic) or glass fiber, or a mat of either woven or unwoven material. \*As for claim 13 carbon fiber and Kevlar are known woven/unwoven materials\*

Re clm 15, Stelle discloses said at least one wire (106 or 108) comprises control means for controlling the movement (the wires are control means connected to a module) of said link assemblies within the segment.

Re clm 17, Stelle discloses that the control means comprises 3 wires (not shown in detail but Figure 5 shows multiple holes capable of receiving the wires also see C2/L48-50).

Re clm 18, Stelle discloses that the wires (106, 108) are tensioned to maintain the links under compression, the arrangement being such that application of differential tension between the wires causes or allows the segment to move or bend.

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Re clm 19, Stelle in view of Balczun discloses that the first link member comprises an outer disc (98) having holes for control wires (Figures 5 and 6) and the second link member comprises an inner disk (88) which is adapted to be disposed generally inwardly of the outer disc (98) and which has a central bore (94) which has a bore to accommodate at least one of control and power means (100) for the work head and a rubber disc layer (Balczun).

Re clm 20, Stelle discloses a plurality of said segments (75-80) in which control means is provide for each segment.

Re clm 21, Stelle discloses each segment terminates in an end cap having wire conduit means for the control wires of other segments of the arm and anchorage means arcuately spaced about the cap for securing the control wires for the segment in question (Figure 6).

Re clm 22, Stelle discloses at least one of the members of each link is provided with means for guiding the wires from one end of the segment to the other (the holes).

Re clm 23, Stelle discloses each wire is disposed externally of the segment links and terminates in a ferrule (110, 112).

Re clm 24, Stelle discloses that each control wire is operated by an actuator (C3/L3-17).

Re clm 25, Stelle discloses each that each cable is provided with an actuator. Also, it would have been obvious to one of ordinary skill in the art at the time of the invention to pass the cables around pulleys to help align the cables before entering the segment.

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Re clm 26, Stelle discloses each link is produced as a pair of half links which permit back to back assembly, the arrangement being such that an inner link (88) and an outer link (98) may be assembled with its associated bonding layer to form unitary link components (75-80), a plurality of which together can be assembled to form a segment.

Re clm 28, Stelle discloses locating dowels (rounded portion of 88) provided in mating holes (90).

Re clms 29 and 30, Stelle discloses an external sleeve (86) which is a bellows-type sheath (see Figure 4).

Re clm 31, Stelle discloses that the sleeve comprises a material and a configuration which is selected to increase the torsional stiffness of the arm (rib portions can only compress until the contact one another).

Re clms 32 and 33, the sleeve is capable of being filled with a lubricant.

Re clm 36, Stelle discloses a link assembly for a robot arm comprising:

- First and third link members (75-80) having respectively adjacent spherical surfaces (88, 90) formed to fit together
- At least one wire (106 or 108) extending from said first link member to said third member said at least one wire including a preload so as to maintain said link assembly under compression (Stelle states that all the joints are prestressed (C4/L37-52), if the joints are prestressed and it is the cables that hold the joints together then the cables must be preloaded).



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Stelle does not disclose a resilient elastomer disposed between said first and second members and the elastomer is bonded to both of the first and second link members, and is sufficiently thin and maintained under compression.

Balczun teaches a resilient elastomer (plastic) bearing (28 part of spherical bearing 22) disposed between two members (20 and 24) and the elastomer is bonded to both of the first and second link members (C1/L35-38) and is sufficiently thin and maintained under compression (disposed between two elements) for the purpose of providing isolation of transmitted vibrations (C1/L6-10).

Upon the combination said adjacent spherical surfaces of said first, second and third link members are keyed or bonded to one another such that during articulation of the arm said third link (28, Balczun) rotates about a point of rotation relative to said first link and the distance between the spherical surfaces (88, 90) of said first and third links remains substantially constant; and said elastomeric material is maintained under compression by said at least one wire such that substantially no compressive deformation of said elastomeric material occurs during rotation.

It would have been obvious to one having ordinary skill in the art at the time of the invention to modify the teachings of Stelle and provide a resilient elastomer bearing disposed between two members and the elastomer is bonded to both of the first and second link members, and is sufficiently thin and maintained under compression, as taught by Balczun, for the purpose of providing isolation of transmitted vibrations.

**Also:**

5. Claims 1-2, 4, 6-13, 15-26, 28-31 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stelle (US Pat. 3,266,059) in view of Raines (US Pat. 5,297,874).

Stelle (US Pat. 3,266,059) discloses a robot arm link assembly (fig. 6) comprising first and second link members (75-80) each adapted for limited movement one with respect to the other and resilient means disposed between said first and second member characterized in that the first and second members are configured in a cooperating mating relationship and at least one wire (106, 108) extending from the links.

However, Stelle (US Pat. 3,266,059) doesn't disclose a plurality of thin layered polyimide (elastomer, Kevlar, ect.) placed between the links.

Raines (US Pat. 5,297,874) discloses a thin plurality of elastomeric layers (polymides, Kevlar, etc.) forming a bearing surface between relatively movable parts. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have utilized the bearing structure of Raines (US Pat. 5,297,874) between the links of Stelle (US Pat. 3,266,059) so as to protect the links from overstress due to outside stimuli, as suggested by Raines (US Pat. 5,297,874).

Furthermore, while a specific thickness is not disclosed by Raines (US Pat. 5,297,874) it would have been obvious to one having ordinary skill in the art at the time the invention was made to have utilized a specific thickness range in order to conform to the compressional force inputs, and/or cost specifications of the assembly, since it has been held that where the general conditions of a claim are disclosed in the prior art,

discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

Additionally, the method by which the elastomeric layer(s) are adhered to the links is a product-by-process recitation, therefore the layer(s) of Raines (US Pat. 5,297,874) must only be theoretically capable to such a procedure, which they are.

Finally, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have made the first and second links separable from one another and halved from themselves so as to allow for easier fabrication (draft angles of molding or casting), since it has been held that constructing a formerly integral structure in various elements involves only routine skill in the art. *Nerwin v. Erlichman*, 168 USPQ 177, 179.

6. Claims 32-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stelle (US Pat. 3,266,059) in view of Raines (US Pat. 5,297,874) as applied to claims 1-13 and 14-31 above, and further in view of Birchard (US Pat. 4,751,821).

Stelle (US Pat. 3,266,059) discloses the claimed invention except for a lubricant cooling means for the robot.

Birchard (US Pat. 4,751,821) discloses a lubricant cooling means for a snake-like robot.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have utilized the lubricant cooling means of Birchard (US Pat. 4,751,821) within Stelle (US Pat. 3,266,059) so as to allow for supplementary actuation of the snake robot assembly.

***Response to Arguments***

7. Applicant's arguments filed June 13, 2006 have been fully considered but they are not persuasive.

8. In response to applicant's argument that the combination of Stelle and Balczun would not function, the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). In this case, Balczun is only being used to teach an elastomeric bearing between two elements. The examiner does not understand the applicants argument that "either the springs would be completely compressed not allowing the arm to effectively rotate or the joints would be relatively loose not preventing the transmission of vibrations" (pg 14 lines 5-7 Remarks). The insertion of an elastomeric bearing between the links would not prevent the device from functioning. The insertion of an elastomeric bearing would prevent transmission of unwanted vibrations but would still allow the device to move. The insertion of an elastomeric bearing between the links does not render the device of Stelle inoperative.

9. It appears to the examiner that on page 14 lines 11-14 of the Remarks the applicant is arguing that because Stelle further uses springs to apply pre-stressing to the joints that it can not be used alone or in combination with Balczun. The fact that Stelle also includes springs does not exclude it as a valid prior art reference. It appears

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that the applicant is arguing, "comprising" vs. "consisting of." In this case the claims are written using the phrase "comprising" which means that the device includes the elements that follow but is not limited to having only those elements. On the other hand the phrase "consisting of," which is not found in the claims, means that and only that is used/shown in the device. The examiner is suggesting that the applicant focus on the structure of the individual links that is in the instant application and not in the prior art, not what else the prior art has as the claims are written using the phrase "comprising." (The examiner suggests the use of language similar to that of clm 19).

10. In response the applicants arguments that Balczun teaches away from an elastomeric bearing that allows for relative rotation. The elastomeric bearing of Balczun does allow for relative rotation in the same way that the instant application does. The elastomeric bearing is keyed or bonded to both the first and second link members, in the same way as the instant application, and when one of the link members is moved relative rotation has to happen between the two links for the joint to function. The bearing of Balczun is used to remove unwanted vibration and does not remove all movement from the system. It should be noted that nowhere in the prior office action did the examiner state that Balczun is provided to isolate movement as alleged by the applicant on page 15 lines 1-3 of the Remarks.

11. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., mathematically defined way) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are

not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

12. In response to the applicant's argument that Balczun is directed toward a system for minimizing movements between members (page 15 line 17-18) the examiner agrees that Balczun teaches minimizing movements caused by vibration, but Balczun does not teach away from minimizing relative movement between the links when a force is applied. When movement does occur (one of the link elements is moved) there is a shearing action in the elastomeric bearing like that of the instant application. Although Balczun uses the bearing to reduce movement between the links movement does happen to a degree. Therefore, the bearing of Balczun functions the same as the bearing of the instant application.

13. In response to the applicant's arguments that Stelle in view of Raines would not result in the presently claimed invention the examiner disagrees. For the same reason set forth above with respect to Stelle in view of Balzcun it is the examiners position that Stelle in view of Raines would result in a functioning device that has a bearing element disposed between the links to protect the links from being overstressed well still allowing for relative movement between the links since Raines is only being used to teach the use of a bearing element between parts. In response to the applicant's remark that there is absolutely no reason to protect the robotic arm from "overstress" (page 17 line 3) the examiner disagrees since it is well known that if stresses are removed from a system the functional life of that system is extended.

14. In response to applicant's argument that Raines is nonanalogous art (pg 17 lines 4-12), it has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In this case, Raines is pertinent to the particular problem with which the applicant is concerned (providing a fixed frictional contact surface [the bearing] between members while at the same time providing the resilient shear [everything is capable of shearing to a degree when a force is applied] capacity necessary to produce stiffness of a joint, specification page 3 line 19-page 4 line 3).

15. The examiner agrees that the applicant's arrangement of the links does eliminate the use of springs. However, the applicant is not claiming the structure and structural relationship between the link elements that eliminates the use of the spring. As the claim is written using the word "comprises" the claim is not construed to devices that do not have springs. The examiner is suggesting the use of language similar to that found in clm 19 to claim the arrangement of the link assemblies and the arrangement of the link assemblies relative to one another that eliminates the need of a spring.

### ***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within

TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The other cited documents disclose different robotic arm arrangements.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to James Pilkington whose telephone number is (571) 272-5052. The examiner can normally be reached on Monday-Friday 8:00AM-4:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard Ridley can be reached on (571) 272-6917. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

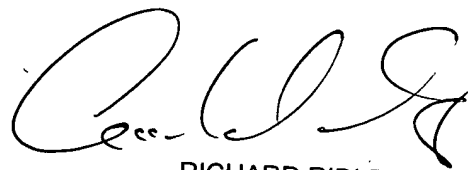


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